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ENTOMOLOGY.[1]

Stemmatoiulus as an Ordinal Type.—The genus Stemmiulus[2] was established by Gervais in 1844. The type species was collected in the mountains of the United States of Colombia. The genus was supposed to differ from Iulus in the possession of a single large ocellus on each side, instead of a cluster of small ocelli, but to subsequent writers this seemed a rather slender basis of generic distinction. Latzel placed Stemmiulus as a doubtful subgenus under Iulus.

Other species with two large ocelli have been described from Jamaica and Ceylon by Karsch and Pocock, but no dissections seem to have been attempted. Mr. Pocock has given me credit for having pointed out to him the fact that the pleural sutures are open, and he has established a separate family for the accommodation of the genus, having previously referred it to the Callipodiæ (Lysiopetalidæ) because the ventral plates are free and the segments striate in a manner resembling that of some of the European Lysiopetalidæ. Mr. Pocock also established[3] a suborder Callipodoidea to contain the Callipodidæ and Stemmiulidæ, but seems later on to have abandoned this arrangement, for we find both families referred back to the Iuloidea.[4]

During the past four year I have had the opportunity of accumulating in Liberia abundant material in this group, and have accomplished several dissections which reveal a series of remarkable characters, and make possible camera drawings of the interesting parts.

The living animals strikingly resemble in form, size, coloration, habits and movements the Iuliform Craspedosomatidæ, such as Cryptotrichus and Underwoodia. No Craspedosomatidæ are, however, found in tropical Africa, so that mimicry will hardly explain the apparent similarity of these really diverse forms. The movements, indeed, are even more vigorous than those of Craspedosomatidæ, and the creatures frequently throw themselves several inches when disturbed. Mr.

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[1] Edited by Clarence M. Weed, Durham, N. H.

[2] This is the original name, and the derivation from στέμμα is evident, but the form seems to be incorrect. A similar carelessness in derivation is that of the names "Craspedosomidæ" and "Chordeumidæ," which classical usage would compel us to write "Craspedosomatidæ" and "Chordeumatidæ."

[3] Journ. Linn. Soc. Zool., XXIV, p. 447.

[4] Zool. Erg. einer Reise in Niederl. Ost-Indian, Herausg. von Dr. Max Weber, p. 376. As this reference cites the former one (Journ. Linn. Soc., XXIV, p. 447) it would seem to be a later publication.

Pocock informed me that the collector of the Ceylon species reported that the animals were saltatory. This apparent jumping motion, is caused by vigorous wriggling of the body. At other times they crawl or run after the manner of other Diplopoda, but are more fleet. Strangely enough, one of several genera of Spirostreptidæ found in Liberia is also very fleet and has the habit of throwing itself by vigorous wriggling in the same way as Stemmatoiulus. In Liberia I collected three well-defined species, here referred to Stemmatoiulus, but noticed no differences in habitat or habits. All were found among fallen leaves and decaying vegetable debris in deep forests or other moist and deeply shaded localities, or rarely in heaps of rubbish in open places.

Structurally considered, these Liberian species show many characters or combinations unique among recent Diplopoda. It will not be possible to separate satisfactorily the ordinal, family, generic and specific characters in this group until the American and Indian forms are better known, and the following subordinal description will probably need modification when further investigation has been made.

STEMMATOIULOIDEA, new Suborder.

Body fusiform, distinctly compressed laterally.

Labrum tridentate, with a median tooth.

Eyes of one or two very large ocelli.

Mandibulary stipe with cardo distinct, subequal in size with the stipe.

Hypostoma present, large.

Mentum entire, very short.

Promentum broad, longer than the mentum.

Lingual laminæ distinct, very large, transversely striate; lingual lobes provided with sense-cones.

Median lobe well-developed, without styliform processes.

Segments not divided by a constriction into anterior and posterior subsegments; the suture inconspicuous or wanting; dorsally with a distinct median suture and four pairs of setiferous punctations; surface divided by longitudinally oblique impressed lines into narrow areas.

Repugnatorial pores present, subdorsal, located in the anterior part of the segments.

Pleuræ incompletely adnate or nearly free from the tergites.

Pedigerous laminæ all free, of two different shapes.

Legs eight-jointed, except the first two pairs.

Seminal opening of males through an unpaired two-jointed, external duct inserted behind the second pair of legs, which are greatly modified.

Both pairs of legs of seventh segment of males replaced by copulatory organs.

Segments of adults 40–50.

Among these characters some are especially noteworthy:

The ocelli are many times larger than those of other Diplopoda, and the small number should not be looked upon as an indication that any reduction or coalescence has taken place, such as sometimes occurs in cave or subterranean forms.

The lingual laminæ of males are as large and as long as the stipes of the gnathochilarium, and are transversely striate. To accommodate these large laminæ the promentum is greatly reduced, but in the female the promentum is larger and the laminæ correspondingly shortened.

The eight-jointed legs are quite different in form from those of any other group of Diplopoda. Seven joints is the number in the other suborders, although the second joint is always very short and in some case is nearly or quite obsolete. The second joint in Stemmatoiulus is also small, though larger than in any other Diplopod, and the additional joint is probably the result of an articulation in last tarsal joint which in other forms is undivided.

In males the second pair of legs is conspicuously reduced and transformed into a pair of hooks probably of use in copulation,

Behind this second pair of legs is inserted an attenuate, apparently two-jointed, external seminal duct which lies back between the coxæ of the third and fourth pairs of legs, which are medianly hollowed out to receive it, as the drawings show. No such structure has been found in other recent Diplopoda, but the Carboniferous Archipolypoda as described and figured by Scudder show a probably homologous feature described by Scudder as an "intromittent organ." The copulation of Stemmatoiulus has not been observed, but as the creatures have the usual copulatory legs on the seventh segment it seems more reasonable to suppose that in Stemmatoiulus, at least, the function of the structure in question is to convey the seminal matter to the copulatory organs.

The pleuræ are neither free after the manner of Glomeris and Siphonotus, nor coalesced and obsolete as in Iulus and Polydesmus, but are anteriorly more or less adnate to the scuta, and posteriorly separated by a deep incision. Compared with those of the Oniscomorpha and Colobognatha the pleuræ of Stemmatoiulus are very small, which suggests the possibility that the pleuræ of Iulus have been lost, and have not so completely disappeared by mere coalescence.

The segments are provided with eight setæ each, instead of six as in Craspedosomatidæ, and they rise from punctations instead of tubercles, though in the Iuliform Craspedosomatidæ the setæ sometimes rise from punctations, e. g. Caseya. The last segment is rudimentary and has four conic processes like those of the last segment of Craspedosomatidæ. The appearance of setæ on the last segment in these diverse forms accords with the known fact of their great constancy in the other suborders in supporting the view that they are primitive characters and hence of great importance in classification and the estimation of affinities.

The repugnatorial pores are subdorsal, located in the anterior part of the segment and occur in an uninterrupted series from the fifth segment. The occurrence of setæ and pores on the same animal indicates that closer affinity may prove to be possible between the Craspedosomatidæ and Callipodidæ than would be indicated by arranging them in separate suborders.

This combination of characters indicates a wide divergence in developmental history from the other recent Diplopod types. This divergence is also indicated by the fact that the affinities of Stemmatoiulus are evidently with the carboniferous forms known as Xylobius. The segments of Xylobius, according to Scudder's diagrams, are divided into so-called "*frusta*" by longitudinal impressed lines not apparently comparable to the striæ of Iulidæ nor to the carinæ of Callipodidæ or Cambalidæ. Hence I have arranged Stemmatoiulus and Xylobius as representatives of suborders[5] under a new ordinal name, Monocheta, coördinate with the Oniscomorpha, Limacomorpha, Colobognatha and other groups noticed below. The comparative study of the Diplopoda necessary in examining the question of the proper systematic value of the characters presented by Stemmatoiulus has led me to look upon the Helminthomorpha of Pocock as a composite group, the different members of which are not necessarily more related to each other than to the Oniscomorpha or Limacomorpha.

An apparently satisfactory means of division into groups the members of which have more evident affinity among themselves, is to be found in the location of seminal opening and the structure of the external seminal ducts when present. Without known exception the characters drawn from these organs are accompanied by a definite complex of other features so that there appears to be ample ground for the claim that the proposed groups[6] are natural ones. The nature of the differences by which the Monocheta are maintained as distinct may be shown by briefly indicating the most important diagnostic features of the different orders with which they have been confused. Complete parallel descriptions are in preparation.

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[5] Suborder Xyloiuloidea, to contain the family Xyloiulidæ, genus Xyloiulus fossils from the Sigillarian stumps of Nova Scotia. Xylobius Dawson is preoccupied, and is replaced by Pyloiulus.

Order MEROCHETA.

Median lobe of gnathochilarium with styliform processes.

Seminal openings of males appearing as perforations of the coxæ of the second pair of legs.

Suborders Polydesmoidea, Craspedosomatoidea, Callipodoidea.

Order MONOCHETA.

As defined above. The affinities, as far as these can be indicated, seem to place this order between the Merocheta and the Diplocheta.

Suborders Stemmatoiuloidea, Xyloiuloidea.

Order DIPLOCHETA.

Seminal openings through paired ducts inserted at the base of the second legs.

Suborders Spirostreptoidea, Cambaloidea, Iuloidea.

Order ANOCHETA.

Labrum with a median sinus and an even number of teeth.

Segments 1–5 with one pair of legs each.

Seminal opening single, median, located at the base of the second legs; external seminal ducts entirely wanting.

Suborder Spiroboloidea.

Family STEMMATOIULIDÆ Pocock.

Stemmiulidæ Pocock, Journ. Linn. Soc., XXIV, p. 477.

Genus STEMMATOIULUS Gervais.

Stemmiulus Gervais, Ann. d. Soc. Entom. d. France; 2 series, II, 1844; 3 series, II, p. 70, Pl. V, fig. 11 (1844).

Type *St. bioculatus* (Gervais and Goudot) ibid.

Locality.—Columbia, temperate regions.

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[6] Annals N. Y. Acad. Sci., Vol. IX, p. 8, 1895. There seems to be no good reason why the groups in question may not be looked upon as orders, as Mr. Pocock has proposed in the case of the Oniscomorpha and Limacomorpha. The characters which separate them are both fundamental and constant.

The type species had but a single ocellus on each side of the head, and may prove to represent a genus distinct from the forms with two ocelli. For the present, however we have no means of estimating the value of this character and the new Liberian species are provisionally described under Stemmatoiulus.[7]

Stemmatoiulus bellus sp. n.

Plates XLI, and XLII, figs. 1–31.

Body distinctly fusiform, especially narrowed caudad.

Vertex even, smooth and shining, very finely striate longitudinally, with a trace of a median suture; no hairs except one on each side rising from a punctation.

Clypeus even, smooth and shining with a few scattered piliferous punctations; immediately above the labrum with a row of peculiar clavate, decurved hairs.

Labrum with a rather deep emargination and three teeth separated by deep incisions.

Eyes of two very large ocelli, the superior of which is larger; a small punctiform sense-organ mesad from between the ocelli.

Antennæ clavate, the second and fifth joints longest.

Gnathochilarium and mandibles, see plates.

First segment semi-elliptical the inferior corners rounded; surface evenly convex, the margins not raised; two or three short striations near the posterior corners; surface apparently smooth and shining; under a lens of sufficient strength it is seen to be very finely striate longitudinally over the entire surface, as are all the other segments; no trace of a median line or suture; eight setæ rising from punctations near the posterior margin.

Subsequent segments with a very distinct median dorsal sulcus; on posterior segments this is gradually more deeply notched posteriorly; the whole surface of the segments is very finely and closely striate longitudinally; in addition to these there are numerous distinct oblique impressed line or striations, higher in front and at subequal distances apart, though closer together laterally than dorsally and closer on the posterior segments than on the anterior; there are about 26 of these oblique lines, 5–7 above the pores. The impressed lines are finely

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[7] I have seen the types of *St. bioculatus* (Gervais and Goudot) and of *St. compressus* Karsch. The latter is a dried female in the Berlin Museum There seem to be six conic setiferous processes on the last segment; the pore is located in the third area from the median line; the striæ are wider apart than in the African animals; the legs shorter; the body strongly compressed, short and robust.

beaded or crossed by minute ridges, something after the manner in which the transverse sutures of certain Polydesmoidea are ornamented. The effect of these impressed striations is to give the body a peculiar satiny sheen. The striations do not appear on the dorsal surface of the first few segments, but come farther up gradually to about the tenth.

Repugnatorial pores beginning on the fifth segment; located subdorsally and on the anterior part of the segments, so far in front that they are frequently concealed by the posterior edges of the adjoining segment. The pores are below the second seta from the middle, though the setæ are near the posterior margin of the segment; the pores are usually just below one of the oblique lines which is then sinuate upward around the pores; sometimes the pore is midway between two lines which are then not sinuate, but are always wider apart than any other lines, for their whole length.

Setæ in four pairs; the lowest pair small and inconspicuous, but always present.

Last segment rudimentary, with four setiferous conic processes.

Anal valves not strongly convex, the margins not compressed or raised; surface moderately hirsute with hairs of different lengths, especially caudad.

Preanal scale nearly semicircular, with the two setæ usual in Diplopoda.

Pleuræ striate in the same manner as the scuta.

Pedigerous laminæ of two sorts, those of the anterior pair of legs of each segment subtrapezoidal, those of the posterior pairs with the posterior corners produced. The spiracles are large and distinct.

First pair of legs six-jointed in both sexes, the three distal joints fringed with long hairs.

Second legs of male modified into hooks; four joints are distinguishable, the two lower nearly coalesced. Second legs of female reduced, five-jointed, the joints fringed with long hairs, as are those of the first pair.

Legs 3–5 of males distinctly crassate, the others slender. The distal joints of the anterior male legs have peculiar stout spines or chitinous processes in addition to the usual and ordinary hairs.

Copulatory legs of male, see figures.

Color a dark though bright, horn-brown; a narrow yellow median stripe; a row of light (whitish) spots in which the pores are located. The dark color stops at the middle line of side, and below this the animal is colored a bright orange or light brownish-yellow; legs and ventral surface pale yellowish or nearly white. Head and antennæ dark. Second and third segments bright yellow, and forming a conspicuous collar.

Length 25–30 mm., width 2·5 mm., dorso-ventral diameter 3 mm. Segments 48–50.

Locality: Not rare in Western Liberia; Monrovia, Muhlenburg Mission, and Mt. Coffee. I have examined about 40 mature specimens. The females seem to be somewhat more numerous than the males.

The above description may be taken as somewhat generic, at least for the Liberian species. In the remaining two only characters differing from those of *St. bellus* are given.

Stemmatoiulus pencillatus sp. n.

Plate XLIII, figs. 32–46.

Body slender, not so distinctly fusiform as in the last species.

Segments with setiferous punctations inconspicuous; dorsal suture and sulcus more distinct and notched posteriorly; the impressed lines more distinct and the surface of the segment between somewhat more convex than in *St. bellus.*

Second male legs with a pencil of long hairs rising from the third joint, where in *St. bellus* there is a cluster of shorter hairs. On the fourth joint is a pectinate row of curved spines in, *St. bellus* represented by a cluster at apex.

Legs 3–5 of males more strongly crassate than in *St. bellus.*

Copulatory legs quite distinct in form, see figures.

Colors in general similar to that of *St. bellus,* but not so bright, mottled horn-brown. Median stripe broader, but rather indistinct, reddish-brown; spots about the pores very indistinct, horn-color, lighter than the surrounding surface. The dark color ceases at about the middle of the side, but not very constantly or abruptly. Immediately below there may be a row of dull orange spots, or the whole lower lateral surface may be a mottled light horn-brown. Feet whitish, antennæ dark, except the last joint. Second and third segments not yellow, but rather darker than the others; the first segment is occasionally yellowish.

Length of male 19 mm., width, 1·25 mm.; female 22 mm. and 1·75 mm., there being a much more noticeable disparity in size than in the preceeding species. Segments 50–53.

Locality: A rare species in Western Liberia; Mt. Coffee and Muhlenburg Mission.

Stemmatoiulus calvus sp. n.

Plate XLIV, figs. 47–57.

Body smaller and less fusiform than in *St. bellus*, but more robust than in *St. pencillatus;* lateral compression not so strong.

Segments with the minute longitudinal striations less distinct than on *St. bellus;* the coarser striations less oblique and less distinct; the pores seem to be slightly more dorsal.

Second male legs almost without hairs on the two distal joints, which are also much more slender than in the two preceeding species.

Length 3–5 distinctly crassate, but less so than in the other Liberian species.

Copulatory legs of characteristic form, see figures. A notable difference is shown in the basal lamina of the anterior face. In both other species this is broad and distally emarginate; in *St. calvus* it runs out into an attenuate process.

Color: In life this species appears to be banded with black and white alternately, as the posterior part of each segment is subhyaline and appears white. In alcohol the color is dark horn-brown, nearly black, somewhat mottled; median dorsal line very narrow orange, sometimes nearly or quite obsolete. A row of lighter horn-brown spots along the pores and another similar row at an equal interval below; the dark color is not interrupted at the median line of side as in the other species, but extends down nearly to the pleural suture. Under surface, legs, and apical joint of antennæ whitish.

Length 22 mm., width 2 mm.; number of segments, 44–47.

Locality.—A rare species in Western Liberia. Found only in the region of the Mangrove Swamps in vicinity of Monrovia; I have collected a few specimens on Bushrod Island and along the Mesurado River, of which two are mature males.

A considerable quantity of young specimens were collected, but they are difficult of determination and have not been given much study. In young individuals of all the species the color is a uniform grayish. I have also collected forms congeneric with the Liberian at Sierra Leone and at Conakry, French Gambia, but no mature males were secured.

The drawings of the Liberian species here submitted are supposed to show, in addition to the specific characters, the apparent constancy of the more fundamental and important features on which the higher divisions have been based. On this account figures of the same structures have been repeated for each species, even when the specific differences were not important.—O. F. Cook.

EXPLANATION OF PLATES.

PLATE XLI.

Stemmatoiulus bellus.—Fig. 1. Gnathochilarium of male; 2. Part of same, more magnified; 3. Gnathochilarium of female; 4. Antenna of male; 5. First pair of legs of male, posterior view; 6. Second pair of male legs, anterior view; 7. Same, posterior view, showing also the external seminal duct; 8. One of the second male legs, lateral view, more magnified; 9. Same, posterior view; 10. Third leg of male, posterior view; 11. Fourth leg of male, posterior view; 12. Fifth leg of male, anterior view; 13. Sixth leg of male, anterior view; 14. Tenth leg of male, anterior view; 15. Male genitalia, anterior view; 16 Same, posterior view.

PLATE XLII.

Stemmatoiulus bellus.—Figs. 17. Anterior pair of legs of a segment from the middle of the body, anterior view; 18. Posterior view of basal portion of same; 19. Posterior pair of legs from same segment; 20. First four segments, ventral face; 21. Lateral and ventral portion of a segment from the middle of the body, showing the pleural suture; 22. Mandible; 23. Head, lateral view, showing antennal socket, two large ocelli, mandibulary stipes and gnathochilarium; 24. Dorsolateral part of a segment, showing the median line at the left, the sculpture, repugnatorial pores, and three setæ; 25. Last three segments, dorsal view; 26. Same, ventral view; 27. Same, lateral view; 28. First pair of legs of female, posterior view; 29. Second pair of legs of female, posterior view; 30. Third pair of legs of female, posterior view; 31. Fourth pair of legs of male, anterior view.

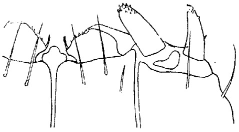
PLATE XLIII.

Stemmatoiulus pencillatus.—Figs. 32. Antenna of male; 33. Gnathochilarium of male; 34. Leg of first pair of male; 35. Second male leg, anterior-lateral view; 36. Second pair of male legs, posterior view, showing also the exterior seminal duct; 37. Third pair of male legs, posterior view; 38. Apical joints of same, more magnified; 39. Fourth pair of male legs, basal joints, posterior view; 40. Fifth pair of male legs, anterior view; 41. Sixth male leg, anterior view; 42. Seventh male leg, anterior view; 43. Male genitalia, anterior view; 44. Same, posterior view; 45. Labrum, exterior view; 46. Same, interior view.

PLATE XLIV.

Stemmatoiulus calvus.—Figs. 47. Gnathochilarium of male; 48. Antenna; 49. First male leg; 50. Second male leg, anterior face; 51.

PLATE XLI.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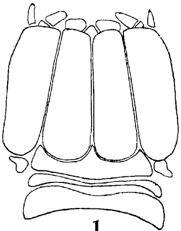
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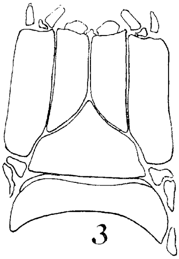
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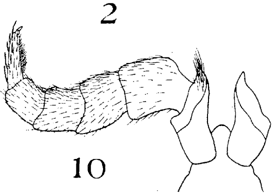
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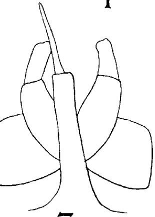
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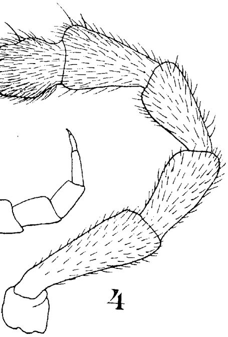
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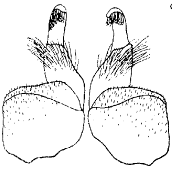
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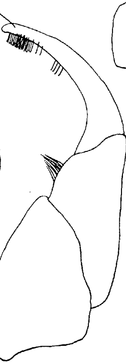
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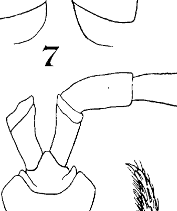
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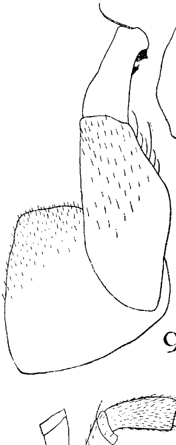
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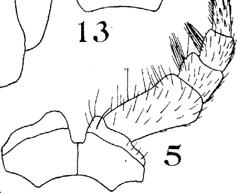
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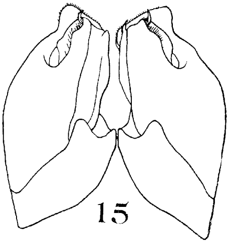
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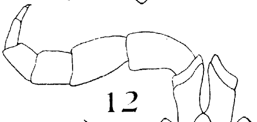
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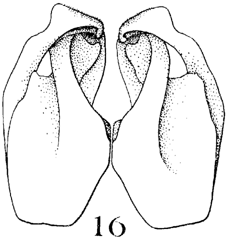
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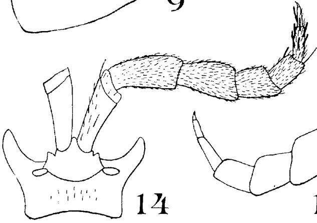
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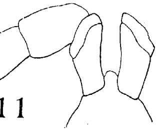
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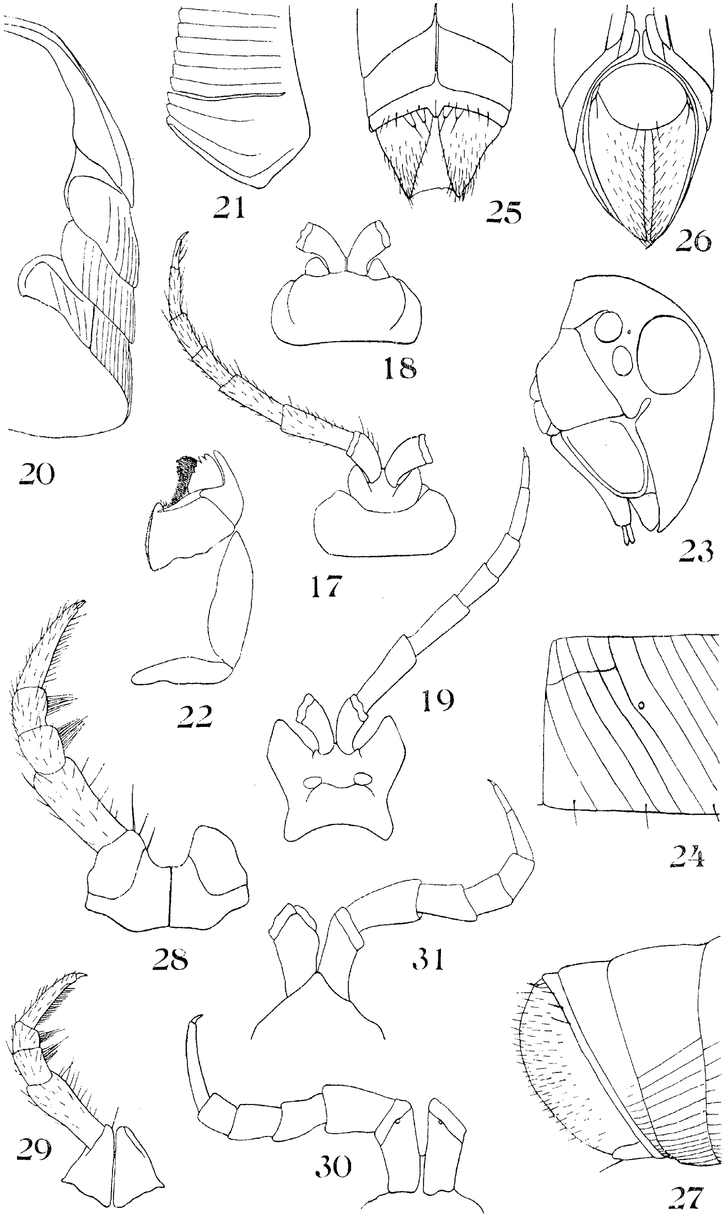
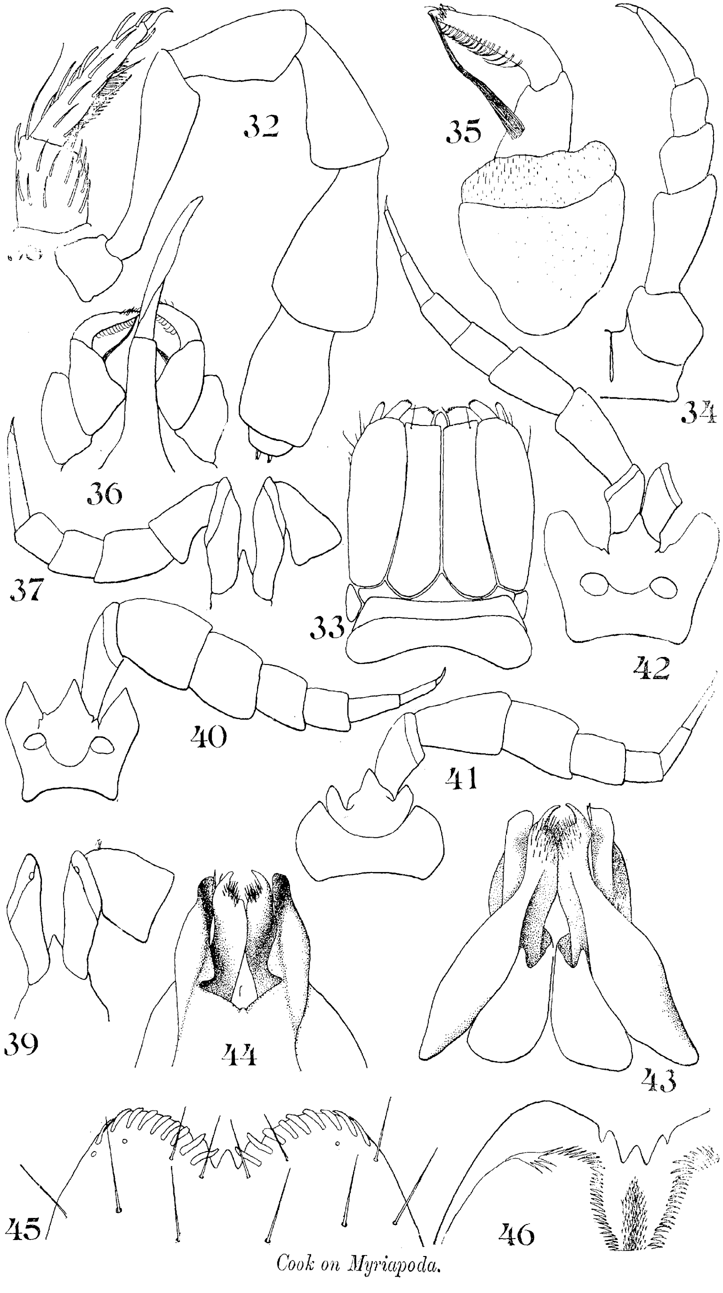
Cook on Myriapoda.

PLATE XLII.



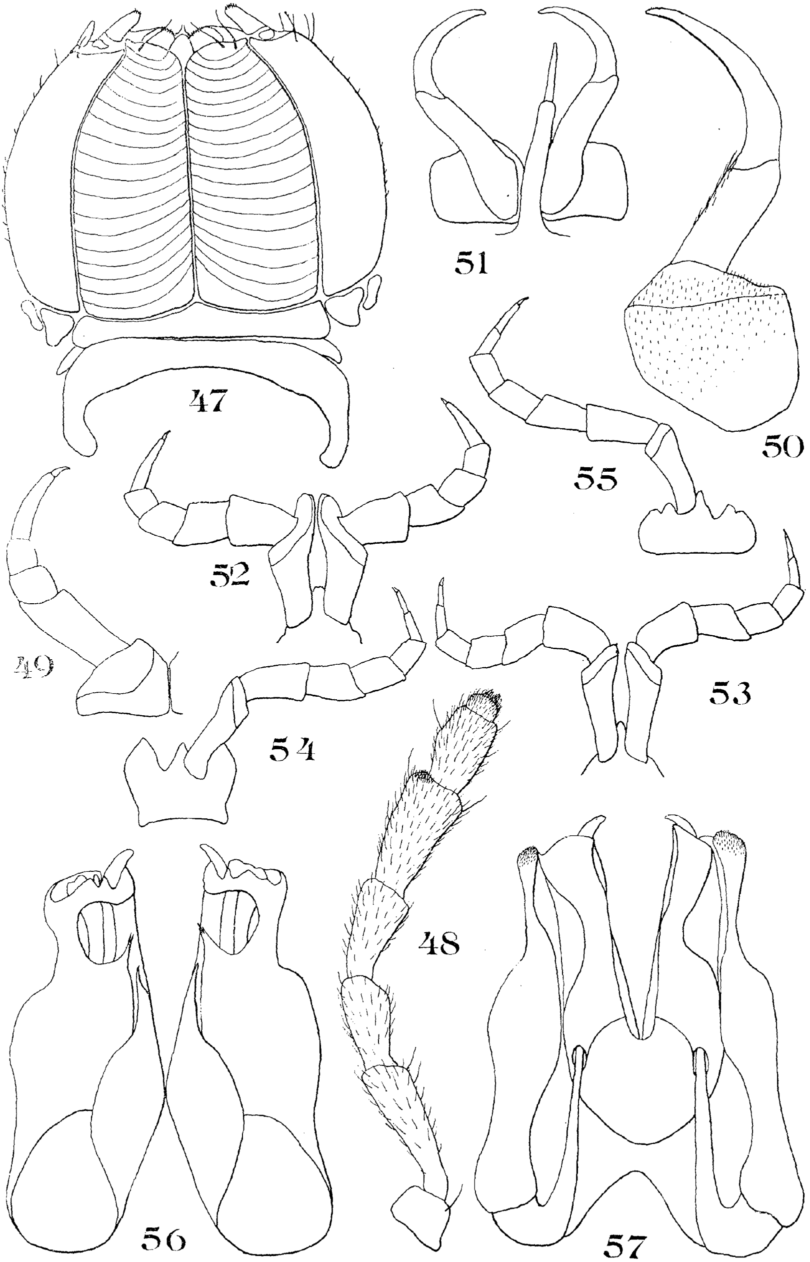
Cook on Myriapoda.

PLATE XLIII.



Cook on Myriapoda.

PLATE XLIV.



Cook on Myriapoda.

Second pair of male legs and external seminal duct, posterior view; 52; Third legs of male, posterior view; 53; Fourth legs of male, posterior view; 54, Fifth legs of male, posterior view; 55; Sixth legs of male, posterior view; 56. Male genitalia, anterior view; 57. Same, posterior view.

EMBRYOLOGY.[1]

Conjugation of the Brandling (continued from page 1027).—It is an error to suppose that there is any great accuracy of adjustment of ring to ring in this process of conjugation; there are no openings of one to be brought opposite to openings in the other but only the long girdle to be applied to the region of the sperm receptacles which open between the ninth and tenth and the tenth and eleventh rings. When the girdle envelopes this region, as seen in the two-constricted parts of the figure, the enlarged intermediate region with the openings of the male ducts may be drawn backwards or forwards without need of accurate coincidence with certain rings on the other worm.

Having hardened conjugating brandlings after killing in boiling water we may cut sections of the two and obtain some insight into the anatomical relations of various parts during, or at least at any given stage of the process of sexual interchange. In longitudinal median sections we find such conditions as are indicated in figure 2 which represents the true relative size and positions of the organs although small details are omitted and the organs are represented in a conventional way. We see the somewhat free head end of the upper worm then the constricted region, the long swollen region, the second constricted part and the head end of the lower worm.

Examining the upper worm from the head backward we see that in the first-eight rings the digestive tract has a large muscular and glandular thickening of its dorsal wall, that the brain lies in the cavity of the third ring while the nerve cord is shown ventrally just as in the normal worm at ordinary times. The ninth and tenth rings form a small swelling sharply cut off by very deep constrictions of the body wall from the regions in front and behind. In these two rings the diges-

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[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.